

## DESCRIPTION

### PAPER POWDER REMOVING APPARATUS

#### TECHNICAL FIELD

The present invention relates to a carton paper powder removing apparatus of a paper liquid container packaging and filling machine for removing paper powder in a carton by inserting a paper powder removing nozzle from an upper opening part of a bottomed tubular carton.

#### RELATED BACKGROUND ART

As shown in a general view of a paper liquid container packaging and filling machine of Fig.3, a liquid packaging quadrangular tubular paper-made container (carton) is supplied to an intermittently rotating mandrel 51, with a flat shaped blanks 1 of a quadrangular tubular carton 1 raised to be formed into a solid shape, as is shown in an appearance perspective view of the blanks of Fig.4. In the mandrel 51, the quadrangular tubular paper-made container is formed in such a manner that each carton is sequentially inserted into and supported by a mandrel which is radially arranged on a rotation support for making a quadrangular tubular paper container; a lower part of a quadrangular tubular body of each carton is folded while the mandrel 51 rotates; and then bottom seal molding is performed by heating. Processing of a bottom-sealed paper-made container 1 follows a course from a sterilization station 52 to a filling station 53, and then to a top sealing station 54 where the paper-made container 1 is molded into a final product (filling carton) 55.

Conventionally, as shown in Fig.5, a paper powder removing nozzle 56 is inserted into an upper opening part of the carton 1 before filling, and while air is blown by using an air jetting port 57 and an air suction port 58 disposed on an tip part of the nozzle, the air is sucked to the outside of the carton, whereby the paper

powder generated by cutting operation or the like and remained in the carton 1 is removed.

The conventional paper powder removing nozzle has various embodiments. For example, embodiments of the nozzle are given such as having a circular-shaped tip part from the flat plane view, thus not completely removing the paper powder of four corners of the quadrangular tubular carton, or having the air suction port disposed at the tip part closer to an inner center part of the tip part and the air suction port disposed on the outer periphery of the tip part, or having the air jetting port disposed at the outer periphery of the tip part to blow air right sideways and the air suction port disposed closer to the inner center of the tip part. Or as another embodiments of the nozzle of the paper powder removing nozzle, at least the tip part thereof has a similar shape to the inner shape of the quadrangular tubular carton in plan external shape and having the air jetting port disposed at the outer periphery of the tip part for blowing air diagonally downward of the outside the outer periphery and the air suction port disposed at the tip part rather than the outer periphery of the tip part (see Japanese patent Laid Open No.2001-97329).

However, a problem involved in the aforementioned conventional art is that the paper powder in the tubular carton can not be sufficiently eliminated.

Also the problem involved therein is that when a large volume of air or a powerful air is blown therein, to remove the paper powder from inside the tubular carton, a significantly large pressure difference occurs at an inside upper part, intermediate part, and upper opening part of the tubular carton, to generate a recess and a deformation of an expansion at the lower part caused by reducing the pressure as shown in Fig.5, resulting in making it difficult to carry in the packaging and filling machine and work in the sterilization station. Therefore, it is necessary to prevent the deformation thus generated.

## DISCLOSURE OF THE INVENTION

In order to solve the above-described problem, an object of the present invention is to provide a carton paper powder removing apparatus of a paper liquid container packaging and filling machine capable of sufficiently removing paper powder in a tubular carton and preventing the carton from being deformed even if a large volume of air or a powerful air is blown therein.

In order to solve the aforementioned problem, the carton paper powder removing apparatus of the paper liquid container packaging and filling machine of the present invention serves as the paper powder removing apparatus of the paper liquid container packaging and filling machine for removing the paper powder adhered to the inside of a bottomed tubular carton which is obtained by molding a flat blanks of a carton for paper liquid container to be formed into a solid shape and sealing a bottom part thereof. The carton paper powder removing apparatus of the paper liquid container packaging and filling machine has a constitution to remove paper powder in the carton, comprising a paper powder removing nozzle reciprocating from an upper opening part of the bottomed tubular carton toward the inside of it and having a jetting port at the tip part of the nozzle, a paper powder return prevention means installed between a nozzle outer wall and a carton inner wall, e.g. between the tip part of the removing nozzle and the base part, and a paper powder collecting means installed near the upper opening part of the bottomed tubular carton and having air suction ports disposed above the space between the nozzle outer wall and the carton inner wall in a state of facing oppositely to each other.

This constitution contributes to providing the carton paper powder removing apparatus of the paper liquid container packaging and filling machine capable of sufficiently removing paper powder in the tubular carton and preventing the carton from being deformed even if a large volume of air or a powerful air is blown therein.

The present invention takes several aspects as follows.

In a first aspect, a paper powder removing apparatus of a paper liquid container packaging and filling machine is provided, which removes paper powder adhered to the inside of a bottomed tubular carton obtained by molding a flat blanks of a carton for paper liquid container to be formed into a solid tubular shape and sealing a bottom part thereof, comprising a paper powder removing nozzle reciprocating from an upper opening part of the bottomed tubular carton toward the inside of the carton and having a jetting port at a tip part of the nozzle; a paper powder return prevention means installed between a nozzle outer wall and a carton inner wall, e.g. between the tip part of the paper powder removing nozzle and a base part; and a paper powder collecting means installed near the upper opening part of the bottomed tubular carton and having air suction ports disposed above the space between the nozzle outer wall and the carton inner wall in a state of facing oppositely to each other, whereby the paper powder in the carton can be removed.

According to the carton paper powder removing apparatus having the aforementioned constitution, since the paper powder removing nozzle reciprocates from the upper opening part of the bottomed tubular carton to the inside of the carton, the paper powder removing nozzle is inserted into the carton from the upper opening part of the bottomed tubular carton. Then, from the jetting port disposed at its tip part, a paper powder removing carrying medium is ejected. The paper powder adhered to the inside of the bottomed tubular carton is pulled away from the inner wall by the medium, and involved in the flow of the carrying medium. The flow of the carrying medium thus involving the paper powder tries to pass through the space between the nozzle outer wall and the carton inner wall, e.g. between the tip part of the paper powder removing nozzle and the base part. In the space between the nozzle outer wall and the carton inner wall, the paper powder return prevention means such as a flow rate regulation horizontal plate is arranged,

whereby the paper powder is prevented from returning to the bottom part of the carton and falling paper powder is trapped. Subsequently, the flow of the carrying medium thus involving the paper powder flies high up into the space between the nozzle outer wall and the carton inner wall, and reaches near the upper opening part of the bottomed tubular carton. Then, the paper powder is taken in the air suction port of the paper powder collecting means, together with the carrying medium. Then, simultaneously with or before or after taking in of the paper powder, the paper powder removing nozzle is pulled out of the upper opening part of the bottomed tubular carton by its reciprocating movement.

In a second aspect, the carton paper powder removing apparatus according to the first aspect is provided, having a blower for collecting a paper powder removing carrying medium, by which removed paper powder is separated from the paper powder collecting means, and sending the medium thus collected to the paper powder removing nozzle.

According to the carton paper powder removing apparatus having the aforementioned constitution, the paper powder removing carrying medium is used by circulating, and therefore scattering of the paper powder and deterioration in a sterilization level can be prevented.

In a third aspect, the carton paper powder removing apparatus according to the second aspect is provided, having a filter on a flow path between the paper powder collecting means and the blower that separates removed paper powder included in the paper powder removing carrying medium sent from the paper powder collecting means.

According to the carton paper powder removing apparatus having the aforementioned constitution, the removed paper powder is separated from the inside of the carton by the filter, and in company with the blower used for circulating the paper powder removing carrying medium, the scattering of the paper powder

and the deterioration in the sterilization level can be prevented.

In a fourth aspect, the carton paper powder removing apparatus according to the first aspect is provided, having a counter for measuring concentration of removed paper powder included in the paper powder removing carrying medium sent from the paper powder collecting means, on a flow path between the paper powder collecting means and the filter.

According to the carton paper powder removing apparatus having the aforementioned constitution, by having the counter, an extent of stain resulting from the paper powder can be measured, and a measurement result thus obtained can be used for various controls that follow thereafter by referring thereto.

In a fifth aspect, the carton paper powder removing apparatus according to the first aspect is provided, having a static electricity removing means near the air jetting port of the paper powder removing nozzle and on an upper stream side of the paper powder removing carrying medium.

According to the carton paper powder removing apparatus having the aforementioned constitution, the static electricity can be removed from electrostatically charged paper powder adhered to the carton, and the paper powder thus free of static electricity can be easily separated from the carton.

In a sixth aspect, the carton paper powder removing apparatus according to the first aspect is provided, having a controller for sending a predetermined control signal to a reciprocating movement drive means of the paper powder removing nozzle and the static electricity removing means and/or the blower, in accordance with an output signal received from the counter.

According to the carton paper powder removing apparatus having the aforementioned constitution, the extent of the stain resulting from the paper powder can be measured by the counter. Therefore, the measurement result can be used for various controls that follow thereafter such as controls of reciprocating

movement of the nozzle, removing static electricity and/or output of the blower.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a schematic sectional view of an embodiment of a carton paper powder removing apparatus according to the present invention,

Fig.2 is a schematic expanded sectional view of the embodiment of Fig.1,

Fig.3 is an appearance view of a paper liquid container packaging and filling machine using the carton paper powder removing apparatus of the present invention,

Fig.4 is an appearance perspective view of blanks, and

Fig.5 is a schematic sectional view of the conventional carton paper powder removing apparatus.

## BEST MODE FOR CARRYING OUT THE INVENTION

Hereunder, embodiments of the present invention will be explained with reference to the drawings.

Fig.3 is an appearance view of a paper liquid packaging and filling machine using a carton paper powder removing apparatus of the present invention. In its embodiment, a flat-shaped blank of a carton 1 is raised in a tubular shape, supplied to an intermittently rotating mandrel 51, and sequentially inserted into and supported by a mandrel which is radially arranged on a rotation support, with a lower part of each carton folded while the mandrel 51 rotates, and then is subjected to bottom seal molding by heating, whereby a tubular paper-made container is formed. Next, processing of the bottom-sealed carton 1 follows a course from a sterilization station 52 to a filling station 53, and then to a top sealing station 54 where a liquid filling paper container 55, e.g. a final product is formed.

In this embodiment, the carton paper powder removing apparatus of the

present invention is installed on a lower stream side of the mandrel 51 and an upper stream side of the filling station 53.

Fig.1 is a schematic sectional view of an embodiment of the carton paper powder removing apparatus according to the present invention. The carton paper powder removing apparatus of the present invention serves as a paper powder removing apparatus which removes paper powder adhered to the inside of a bottomed tubular carton obtained by molding a flat blanks of a carton for paper liquid container as shown in Fig.4(a) to be formed into a solid shape as shown in Fig.4(b) and sealing a bottom part thereof. In an apparatus of the aforementioned embodiment, a paper powder removing nozzle 2 is reciprocatingly moved in a vertical direction from the upper opening part of the bottomed tubular carton 1, which is intermittently carried in a direction shown by an arrow in the figure, toward the inside of the carton by an actuator 3 (air cylinder which telescopes in a vertical direction). The paper powder removing nozzle 2 has a jetting port 4 at a tip part thereof. A paper powder return prevention means (not shown in Fig.1) is installed on a space between an outer wall of the nozzle 2 and an inner wall of the carton 1, e.g. between the tip part of the paper powder removing nozzle 2 and a base part.

Fig.2 is a schematic expanded sectional view of the aforementioned embodiment. In this embodiment, a flow rate regulation horizontal plate 7 is provided at the tip part of the paper powder removing nozzle 2, which prevents the paper powder from returning to a carton bottom part and traps falling paper powder on an upper surface of the horizontal plate 7.

In this embodiment, a box-shaped paper powder collecting means 5 is provided near the upper opening part of the bottomed tubular carton 1, and suction ports 6 are disposed above the space between the nozzle outer wall and the carton inner wall in a state of facing oppositely to each other.

In this embodiment, since the paper powder removing nozzle 2



reciprocatingly moves by the actuator 3, the nozzle 2 is inserted from the upper opening part of the bottomed tubular carton 1 toward the inside of the carton, to blow a paper powder removing carrying medium (such as sterile compressed air (aseptic air) shown by an arrow in the figure) powerfully from the jetting port 4 disposed at the tip part. The paper powder adhered to the inside of the bottomed tubular carton 1 is pulled away from the inner wall by the aforementioned medium and involved in the flow of the carrying medium. The flow of the carrying medium thus involving the paper powder tries to pass through the space between the nozzle outer wall and the carton inner wall, e.g. between the tip part of the paper powder removing nozzle and the base part. In this space, the flow rate regulation horizontal plate 7 is formed, to prevent the paper powder from returning to the carton bottom part and trap the falling paper powder. Then, the flow of the carrying medium thus involving the paper powder flies high up into the space between the nozzle outer wall and the carton inner wall, and reaches near the upper opening part of the bottomed tubular carton 1. The paper powder is taken in the suction ports 6 of the paper powder collecting means 5, together with the carrying medium. Then, simultaneously with or before or after taking in of the paper powder, the paper powder removing nozzle 2 is pulled out to the outside the carton from the upper opening part of the bottomed tubular carton 1, by the reciprocating movement of the nozzle 2.

In this embodiment, the jetting port has a shape or constitution of a hole with a large diameter. However, it may have a plurality of holes or a hole with a small diameter.

This embodiment has a blower 8 for recovering the paper powder removing carrying medium, in which the removed paper powder is separated, from the paper powder collecting means 5 and sending the paper powder removing carrying medium thus recovered to the paper powder removing nozzle 2.

By this embodiment, the paper powder removing carrying medium is used

by circulating, and scattering of the paper powder and the deterioration in the sterilization level can be prevented.

In this embodiment, a filter 9 for separating the removed paper powder included in the paper powder removing carrying medium sent from the paper powder collecting means 3 is formed on a flow path between the paper powder collecting means 5 and the blower 8. By this embodiment, the paper powder removed from the inside of the carton is separated by the filter 9, and in company with the blower 8 used for circulating the paper powder removing carrying medium, the scattering of the paper powder and the deterioration in the sterilization level can be prevented.

In this embodiment, a counter 10 is arranged on the flow path between the paper powder collecting means 5 and the filter 9, for measuring the concentration of the removed paper powder included in the paper powder removing carrying medium sent from the paper powder collecting means 5.

By having the counter 9 according to this embodiment, the extent of the stain resulting from the paper powder can be measured, and the measurement result can be used for various controls that follow thereafter by referring thereto.

In this embodiment, a static electricity removing means 11 is installed near the jetting port 4 of the paper powder removing nozzle 2 and on an upper stream side of the paper powder removing carrying medium. Therefore, the static electricity can be removed from electrostatically charged paper powder adhered to the carton, and the paper powder thus free of static electricity can be easily separated from the carton.

In this embodiment, a controller 12 is arranged for sending the predetermined control signal to the actuator 3 of the paper powder removing nozzle 2 and the static electricity removing means 11 and the blower 8, in accordance with the output signal received from the counter 10.

By this embodiment, the extent of the stain due to the paper powder can be measured by the counter, and the measurement result can be used for controlling the reciprocating movement of the nozzle, static electricity removal and output of the blower, which is then displayed on a display 13.

As described above, according to the present invention, the paper powder in the tubular carton can be sufficiently removed, and an advantageous effect can be obtained, such that the carton is prevented from being deformed even if a large volume of air or a powerful air is blown therein.

#### INDUSTRIAL APPLICABILITY

The paper powder removing apparatus of the present invention is used in a packaging container to store a liquid food such as milk and soft drink.